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**PLANT NETWORK SYSTEM**

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(57) Summary

Objective: To enable plant maintenance crew members to access, at a high speed, plant information constituted by information necessary for the maintenance of a plant.

Solution mechanism: The remote access server (RAS) (102) obtains area information which shows an area in which the PHS terminal (106) exists from the intercom switching machine (107), specifies a plant which is being checked by a plant maintenance crew member in possession of the PHS terminal (106) based on said area information, and then specifies a plant to be checked next by said plant maintenance crew member with reference to a scheduled checkup route for the plant maintenance crew memorized and managed by the server itself. Prior to the commencement of the checkup of the plant scheduled to be checked next, it obtains plant information necessary for its checkup and then feeds it in advance into the information processing terminal (112), which is being connected to the PHS terminal (106) carried by said plant maintenance crew member, via the intercom wireless telephone network (108) for realizing a state where the plant information necessary for the next checkup is being cached in the information processing terminal (112).

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<sup>1</sup> Numbers in the margin indicate pagination in the foreign text.

## Patent Claims

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### Claim 1

A plant network system characterized by the facts that

It possesses not only an intercom wireless telephone network constituted by multiple wireless telephone terminals, multiple wireless base stations which are configured to cover areas that include the respective plants, and an intercom switching machine which memorizes and manages the area information that shows the areas in which the respective wireless telephone terminals exist but also a server connected to the aforementioned intercom switching machine and that

The aforementioned server possesses

A plant information memory mechanism into which plant information constituted by information necessary for the aforementioned multiple plants has been memorized for each of said plants,

A scheduled checkup route memory mechanism into which the sequential order of plants to be checked by multiple plant maintenance crew members who each possess the aforementioned multiple wireless telephone terminal has been memorized for each of said plant maintenance crew members,

A plant area information memory mechanism into which plant area information that shows an area which includes each of the aforementioned multiple plants has been memorized for each plant,

An area information acquisition mechanism which acquires the area information that is being memorized and managed by the aforementioned intercom switching machine,

A currently checked plant specification mechanism which specifies the plant which is being currently checked by each plant maintenance crew member based on the area information acquired by the aforementioned area information acquisition mechanism and on the plant area information memorized by the aforementioned plant area information memory mechanism,

A next-to-be-checked plant specification mechanism which, with regard to the plant maintenance crew member for whom the plant has been specified by the aforementioned currently checked plant specification mechanism, specifies the plant which is scheduled to be checked next by said plant maintenance crew member, and

A plant information transmission mechanism which transmits, among the sets of plant information memorized by the aforementioned plant area information memory mechanism, the plant information corresponding to the plant specified in relation to the plant maintenance crew member for whom said plant has been

specified by the aforementioned currently checked plant specification mechanism into the information processing terminal connected to the wireless telephone terminal carried by said plant maintenance crew member via the aforementioned intercom wireless telephone network.

#### Claim 2

A plant network system characterized by the fact that, with regard to the plant network system specified in Claim 1, areas covered respectively by the aforementioned multiple wireless base stations and areas in which the aforementioned PHS terminals are called by the aforementioned intercom switching machine upon the arrivals of signals at said PHS terminals mutually correspond at a 1 : 1 ratio.

#### Claim 3

A plant network system characterized by the fact that, with regard to the plant network system specified in Claim 1 or 2, the area information acquisition mechanism of the aforementioned server acquires the area information memorized and managed by the aforementioned intercom switching machine by accessing said area information at a predetermined periodic frequency.

#### Claim 4

A plant network system characterized by the facts that, with regard to the plant network system specified in Claim 1 or 2, the

aforementioned intercom switching machine, notifies, in a case where the aforementioned area information has become renewed, the aforementioned server accordingly and that the area information acquisition mechanism of the aforementioned server acquires the area information memorized and managed by the aforementioned intercom switching machine by accessing said area information in a case where it has been notified by the aforementioned intercom switching machine.

#### Claim 5

A plant network system characterized by the facts that, with regard to the plant network system specified in Claim 1 or 2, the aforementioned intercom switching machine, notifies, in a case where the aforementioned area information has become renewed, the aforementioned server of the renewed area information and that the area information acquisition mechanism of the aforementioned server acquires the area information memorized and managed by the aforementioned intercom switching machine by receiving the notification from the aforementioned intercom switching machine.

#### Claim 5

A plant network system characterized by the fact that, with regard to the plant network system specified in Claim 1, 2, 3, 4, or 5, the aforementioned server additionally possesses

A response manual information memory mechanism which is configured for each of the aforementioned multiple plants, which is further connected to multiple controllers that collect the plant control information that shows the operative state of the corresponding plant, and into which response manual information constituted by information necessary during the renditions of responses to anomalies of the aforementioned multiple plants has been memorized for each plant,

An anomalous plant detection mechanism which detects plants which are likely to experience anomalies based on the sets of plant control information collected by the aforementioned multiple controllers, and

A response manual information transmission mechanism which transmits, among the sets of response manual information memorized by the aforementioned response manual information acquisition mechanism, the response manual information corresponding to the plant detected by the aforementioned anomalous plant detection mechanism into the information processing terminal connected to the wireless telephone terminal carried by at least one member selected from between the plant maintenance crew member who is currently checking the plant detected by the aforementioned anomalous plant detection mechanism and the plant maintenance crew member who is scheduled next to check the plant detected by the



aforementioned anomalous plant detection mechanism via the  
aforementioned intercom wireless telephone network.

Detailed explanation of the invention

[0001]

(Technical fields to which the invention belongs)

The present invention concerns a system for providing plant information constituted by information necessary for checkups to plant maintenance crew members who check plants, and in particular, it concerns a plant network system which, even in cases where high-volume image data (e.g., drawing information, etc.) prevail as the plant information, is capable of transmitting said plant information both quickly and accurately to an information processing terminal connected to /3  
a wireless telephone terminal carried by a plant maintenance crew member(s) by using an intercom wireless telephone network with a relatively narrow band (e.g., PHS (personal handy phone system), etc.).

[0002]

(Prior art)

Generally speaking, intercom paging systems, work contact communications systems, etc. are known as examples of intercom wireless systems for which intercom or otherwise limited areas are designated as service areas.

[0003]

The objective of the intercom paging system is to transmit, in relation to members who carry offspring stations and have been dispatched from a singular center and who may be either adventitiously on the move or stationary at a specified site, unilateral commands or simple information from a parent station located at said center by using a low-electric-power facility of the 400 MHz band.

[0004]

Moreover, the work contact communications system may, for example, support, by using a wireless facility with an air line electric power of 1 mW or less within an operation premise, contact communications between a board member stationed at a singular center, namely an instrument room, and maintenance crew members who have been dispatched to work sites while carrying offspring stations.

[0005]

Voice communications or transfer of simple information from the parent station side is presumed by each of these intercom

wireless systems, and they have failed to take into account a data communications mode whereby the offspring station side actively references information.

[0006]

The PHS, on the other hand, is known as a wireless communications system with a high data communications potential. The PHS is peculiarly characterized by the direct transmittability of modem signals in that voice signals are transmitted by the 32 kbps voice compression format.

[0007]

Incidentally, the intercom wireless system and PHS are discussed in detail in Ido Tsushin Handbook (edited by Tadao Saito and Keiji Tachikawa, published by Ohm Co. on November 15, 1995), for example.

[0008]

(Problems to be solved by the invention)

Although the transmission rates have been improved for wireless communications by the aforementioned techniques of the prior art, their transmission rates are lower than those of non-wireless LANs by two orders of significance, and accordingly it is difficult to embody a server-client constitution identical to that of a non-wireless network system of the prior art by using a PHS.

[0009]

It is also problematic from the standpoint of the quality of communications. In other words, speeds of 10 Mbps to 100 Mbps are achieved by ether nets or FDDIs (fiber distributed data interfaces), and since the delays are as brief as the msec. order, session severances are unlikely to occur. The speed of the PHS, in contrast, is 32 kbps at the most, and since the maximal delay is approximately 4 sec., session severances are likely to occur, and thus, the stability is inferior.

[0010]

An SQL (structured query language), furthermore, becomes issued from an application at the time of a database access, and since command groups corresponding to such functions as "connect," "query," etc. become mobilized by a singular SQL, a heavy traffic is incurred in actuality. It is accordingly difficult to import this [sic] into a wireless system environment directly and to provide a system wherein an SQL is issued to the server from the client.

[0011]

In a case where a session severance occurs in an unstable connection environment, furthermore, the overhead increases due to the retry burden imposed by the session redesignation, and since

the delay is significant, it is problematic in that the response comes to exceed the mobile work tolerance limit.

[0012]

One objective of the present invention is to provide a plant network system which, prior to the commencement of the checkup of a plant to be checked next by a plant maintenance crew member who checks such plants, enables the plant maintenance crew member to access plant information at a high speed by feeding in advance the plant information constituted by information necessary for the checkup of the plant scheduled to be checked next into an information processing terminal connected to a wireless telephone terminal carried by said plant maintenance crew member via an intercom wireless telephone network.

[0013]

Another objective of the present invention, furthermore, is to provide a plant network system which, in a case where a plant which is likely to experience an anomaly has been detected, transmits response manual information constituted by information necessary during the rendition of a response to the anomaly of said plant into an information processing terminal connected to a wireless telephone terminal carried by at least one member selected from between the plant maintenance crew member who is currently checking said plant and the plant maintenance crew

member who is scheduled next to check said plant via an intercom wireless telephone network for enabling said plant maintenance crew member to access the response manual information at a high speed.

[0014]

(Mechanism for solving the problems)

In order to achieve the aforementioned objectives, the first embodiment of the present invention provides a plant network system which possesses not only an intercom wireless telephone network constituted by multiple wireless telephone terminals, multiple wireless base stations which are configured to cover areas that include the respective plants, and an intercom switching machine which memorizes and manages the area information that shows the areas in which the respective wireless telephone terminals exist but also a server connected to the aforementioned intercom switching machine, whereas the aforementioned server possesses a plant information memory mechanism into which plant information constituted by information necessary for the aforementioned multiple plants has been memorized for each of said plants, a scheduled checkup route memory mechanism into which the sequential order of plants to be checked by multiple plant maintenance crew members who each possess the aforementioned

multiple wireless telephone terminal has been memorized for each of said plant maintenance crew members, a plant area information memory mechanism into which plant area information that shows an area which includes each of the aforementioned multiple plants has been memorized for each plant, an area information acquisition mechanism which acquires the area information that is being memorized and managed by the aforementioned intercom switching machine, a currently checked plant /4

specification mechanism which specifies the plant which is being currently checked by each plant maintenance crew member based on the area information acquired by the aforementioned area information acquisition mechanism and on the plant area information memorized by the aforementioned plant area information memory mechanism, a next-to-be-checked plant specification mechanism which, with regard to the plant maintenance crew member for whom the plant has been specified by the aforementioned currently checked plant specification mechanism, specifies the plant which is scheduled to be checked next by said plant maintenance crew member, and a plant information transmission mechanism which transmits, among the sets of plant information memorized by the aforementioned plant area information memory mechanism, the plant information corresponding to the plant specified in relation to the plant maintenance crew member for

whom said plant has been specified by the aforementioned currently checked plant specification mechanism into the information processing terminal connected to the wireless telephone terminal carried by said plant maintenance crew member via the aforementioned intercom wireless telephone network.

[0015]

Incidentally, if areas covered respectively by the aforementioned multiple wireless base stations and areas in which the aforementioned PHS terminals are called by the aforementioned intercom switching machine upon the arrivals of signals at said PHS terminals are designated to mutually correspond at a 1 : 1 ratio with regard to the first embodiment, it becomes possible to construct the system with ease in a case where the plant information is transmitted from the aforementioned server side to the aforementioned wireless telephone terminal.

[0016]

The area information memorized and managed by the aforementioned intercom switching machine may, furthermore, be accessed by the area information acquisition mechanism of the aforementioned server at a predetermined periodic frequency with regard to the first embodiment for enabling the acquisition of said area information.

[0017]



If the aforementioned intercom switching machine is designed, in a case where the aforementioned area information has become renewed, to notify the aforementioned server accordingly with regard to the first embodiment, furthermore, the area information acquisition mechanism of the aforementioned server can, in a case where it has become notified by the aforementioned intercom switching machine, access the area information memorized and managed by the aforementioned intercom switching machine for enabling the acquisition of said area information.

[0018]

If the aforementioned intercom switching machine is designed, in a case where the aforementioned area information has become renewed, to notify the aforementioned server of the renewed area information with regard to the first embodiment, furthermore, the area information acquisition mechanism of the aforementioned server can acquire the area information memorized and managed by the aforementioned intercom switching machine by receiving the notification from the aforementioned intercom switching machine.

[0019]

In order to achieve the other objective, furthermore, the second embodiment provides an embodiment corresponding to the first wherein the aforementioned server additionally possesses a response manual information memory mechanism which is configured

for each of the aforementioned multiple plants, which is further connected to multiple controllers that collect the plant control information that shows the operative state of the corresponding plant, and into which response manual information constituted by information necessary during the renditions of responses to anomalies of the aforementioned multiple plants has been memorized for each plant, an anomalous plant detection mechanism which detects plants which are likely to experience anomalies based on the sets of plant control information collected by the aforementioned multiple controllers, and a response manual information transmission mechanism which transmits, among the sets of response manual information memorized by the aforementioned response manual information acquisition mechanism, the response manual information corresponding to the plant detected by the aforementioned anomalous plant detection mechanism into the information processing terminal connected to the wireless telephone terminal carried by at least one member selected from between the plant maintenance crew member who is currently checking the plant detected by the aforementioned anomalous plant detection mechanism and the plant maintenance crew member who is scheduled next to check the plant detected by the aforementioned anomalous plant detection mechanism via the aforementioned intercom wireless telephone network.

[0020]

(Application embodiments of the invention)

In the following, an application embodiment of the present invention will be explained with reference to figures.

[0021]

Figure 1 is a diagram which shows the overall constitution of the plant network system of an application embodiment of the present invention.

[0022]

As Figure 1 indicates, the plant network system of this application embodiment of the present invention is characterized by a constitution wherein the information server (101), the remote access server (RAS) (102), and the control server (103) are mutually connected via an information LAN (local area network).

[0023]

As Figure 1 indicates, furthermore, a constitution wherein the control server (103) and multiple controllers (104) are mutually connected via a control LAN is provided by the plant network system of this application embodiment of the present invention.

[0024]

As Figure 1 indicates, furthermore, the intercom wireless telephone network (108), which, as will be discussed later, is constituted by multiple wireless base stations (105), multiple PHS terminals (106), and the intercom switching machine (107), is used in the plant network system of this application embodiment of the present invention, and accordingly, a constitution wherein the RAS (102) and the intercom switching machine (107) are mutually connected via a communications line is provided.

[0025]

The information server (101) possesses the database (111), into which the respective sets of the plant information (109), namely information necessary for the plant checkup, and the response manual information (110), namely information necessary during the renditions of responses to anomalies plants, have been memorized, and this server engages in actions of managing the plant information (109) and response manual information (110).

[0026]

Incidentally, the plant information (109) and response manual information (110) are memorized into the database (111) together with the plant IDs (201) of multiple plants, as Figure 2 (a) indicates.

[0027]

The RAS (102), furthermore, is a server which engages in an action of transmitting the plant information (109) or response manual information (110) being managed by the information server (101) into the information processing terminal (112), which is connected to the PHS terminal (106) carried by a plant maintenance crew member who checks plants, via the intercom wireless telephone network (108).

[0028]

The control server (103), furthermore, is a server which possesses the database (114), into which the sets of plant control information (113) gathered by the controllers (104) have been memorized, and which engages in an action for managing the plant control information (113).

[0029]

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In the above, at least one each of the controllers (104) is configured for each of the multiple plants, and it serves a function of gathering the plant control information (113), namely information that shows the operative status of the corresponding plant. The plant control information (113) is thereby memorized into the database (114) together with the controller ID (202) of at least one controller (104) as well as the respective plant IDs (203) of the multiple plants, as Figure 2 (b) indicates.

[0030]

The first characteristic of the plant network system of this application embodiment of the present invention lies in the fact that, prior to the commencement of the checkup of the plant scheduled to be checked next by a plant maintenance crew member who checks the plants, it enables said plant maintenance crew member to access the plant information (109) at a high data access speed by feeding in advance the plant information (109) corresponding to the plant scheduled to be checked next into the information processing terminal (111) [sic: Presumably "(112)"] connected to the PHS terminal (106) carried by said plant maintenance crew member via the intercom wireless telephone network (108).

[0031]

The second characteristic of the plant network system of this application embodiment of the present invention, furthermore, lies in the fact that, in a case where a plant which is likely to experience an anomaly has been detected, it transmits the response manual information (110) constituted by information necessary during the rendition of a response to the anomaly of said plant into the information processing terminal (111) [sic: Presumably "(112)"] connected to the wireless telephone terminal (106) carried by at least one member selected from between the plant

maintenance crew member who is currently checking said plant and the plant maintenance crew member who is scheduled next to check said plant via the intercom wireless telephone network (108) for enabling said plant maintenance crew member to access the response manual information (110) at a high speed.

[0032]

Next, the action ascribed to the aforementioned first characteristic will be explained.

[0033]

For the purpose of feeding in advance the plant information (109) corresponding to the plant scheduled to be checked next, it is necessary to specify the plant which is being currently checked by the plant maintenance crew member (hereafter referred to as the "currently checked plant") and the plant scheduled to be checked next (hereafter referred to as the "next-to-be-checked plant").

[0034]

In this context, the action for specifying the currently checked plant will be initially explained.

[0035]

As far as the plant network system of this application embodiment of the present invention is concerned, the multiple wireless base stations (105) may, for example, be configured

respectively to cover areas which include each of the multiple plants, as Figure 3 indicates.

[0036]

In the example of Figure 3, the wireless base stations A (105a) is configured to cover area #1 (302a), which includes the plant A (301a), whereas the wireless base stations B (105b) is configured to cover area #2 (302b), which includes the plant B (301b), whereas the wireless base stations C (105c) is configured to cover area #3 (302c), which includes the plant B (301c).

[0037]

Incidentally, a single plant will be regarded as a unit of a singular checkup target, and therefore, the singular areas and singular plants covered by the respective wireless base stations (105) are designated to mutually correspond at a 1 : 1 ratio, whereas in a case where two or more plants are regarded as a unit of a singular checkup target, these plants may be designated to correspond to a singular area.

[0038]

As Figure 3 indicates, furthermore, the intercom switching machine (107) is constituted within the intercom wireless telephone network (108) to memorize and manage the area information that indicates the areas in which the respective PHS



terminals (106) exist based on the positional registration executed via the PHS terminals (106).

[0039]

Figure 4 is a demonstrational diagram which shows the positional registration executed via the PHS terminal (106).

[0040]

In Figure 4, in a case where a plant maintenance crew member who is carrying the PHS terminal (106) moves from area #1 (302a), which is covered by the wireless base station A (105a), to area #2 (302b), which is covered by the wireless base station B (105b), for example, the movement is detected by the PHS terminal (106) carried by the plant maintenance crew member, and as (402) indicates in Figure 4, a positional registration request becomes transmitted to the intercom switching machine (107) via the wireless base station B (105b).

[0041]

The intercom switching machine (107) renews the area information (401) memorized and managed by itself based on this positional registration request.

[0042]

Incidentally, the area information (401) is specifically a table wherein the correspondences of the area IDs (502) of the areas in which multiple PHS terminals (106) exist with the

respective terminal IDs (501) of said PHS terminals (106) are established, as Figure 5 indicates, and this table serves a function of determining the area to which broadcast information that signifies the arrival of a call at the PHS terminal (106) is scheduled to be transmitted at the time of its arrival.

[0043]

Thus, as far as the plant network system of this application embodiment of the present invention is concerned, the areas covered respectively by the multiple wireless base stations (105) and areas in which the PHS terminals (106) are called by the intercom switching machine (107) at the time of the arrival of a call at each PHS terminal (106) are designated to mutually correspond at a 1 : 1 ratio.

[0044]

Figure 6 is a sequential diagram pertaining to a case where various sets of information concerning the positional registration are exchanged between the PHS terminals (106) and wireless base stations (105).

[0045]

As Figure 6 indicates, the PHS terminal (106) issues, upon its movement into a new area, the link channel establishment request (601) to the wireless base station (105) that covers the

post-movement area and then receives the link channel assignment (602) from the wireless base station (105).

[0046]

The PHS terminal (106) subsequently issues the SABM (set asynchronous balanced mode) (603) to the wireless base station (105) for the purpose of designating the data link level connection and then receives the UA (unnumbered acknowledgment) (604) from the wireless base station /6 (106) [sic: Presumably "(105)"]. It is thus that connections become established at both physical and data link levels, based on which the PHS terminal (106) issues the positional registration request (605) to the wireless base station (105) in the context of serving a third layer level function.

[0047]

The wireless base station (105), upon the reception of the positional registration request (605), transfers the received positional registration request (605) to the intercom switching machine (107). It is thus that the intercom switching machine (107) comes to renew the area information (401) memorized and managed by itself.

[0048]

Incidentally, the acknowledgment request (606) and the acknowledgment response (607) are exchanged between the wireless

base station (105) and the PHS terminal (106) for enhancing the security.

[0049]

Upon the renewal of the area information (401) in the intercom switching machine (107), the PHS terminal (106) receives the positional registration acceptance (608) from the wireless base station (105), and for the purpose of severing the connection at the data link level, it exchanges the DISC (disconnect) (609) and the UA (610) with the wireless base station (105), and finally, it exchanges the wireless channel severance (611) and the wireless channel severance completion (612) with the wireless base station (105) for the purpose of severing the connection at the physical level.

[0050]

Incidentally, as far as the plant network system of this application embodiment of the present invention is concerned, the PSA (102) [sic] "steals" and acquires the area information (401) memorized and managed by the intercom switching machine (107) according to the aforementioned procedures and then specifies the currently checked plant based on the acquired area information (401).

[0051]

In other words, as (701) in Figure 7 (a) indicates, the RAS (102) may, for example, obtain the area information (401) by polling the area information (401) memorized and managed by the intercom switching machine (107) at a predetermined periodic frequency.

[0052]

As (702) in Figure 7 (b) indicates, furthermore, the intercom switching machine (107) notifies, in a case where the area information (401) has become renewed, the RAS (102) accordingly, whereas as (703) in Figure 7 (b) indicates, in a case where it becomes notified by the intercom switching machine (107), the RAS (102) acquires the area information (401) by accessing the area information (401) memorized and managed by the intercom switching machine (107).

[0053]

As (704) in Figure 7 (c) indicates, furthermore, the intercom switching machine (107) notifies, in a case where the area information (401) has become renewed, the RAS (102) of the renewed area information (401), whereas the RAS (102) is capable of acquiring the area information (401) memorized and managed by the intercom switching machine (107) by receiving the notification from the intercom switching machine (107).

[0054]

Upon the acquisition of the area information (401), the RAS (102) renews the currently checked plant information memorized and managed by itself.

[0055]

Incidentally, as Figure 8 indicates, the currently checked plant information is specifically a table wherein the correspondences of the terminal IDs (802) area of the PHS terminals (106) carried by multiple plant maintenance crew member names (801) not only to the area IDs (803) of the areas in which multiple PHS terminals (106) carried by said plant maintenance crew members exist but also to the plant ID (804) of the currently checked plant for each of said plant maintenance crew members.

[0056]

In the above, a fixed correspondence relationship suffices between the plant maintenance crew member name (801) and the terminal ID (802) with regard to the terminal ID (802), and therefore, a fixed value may be designated on the table shown in Figure 8, or it may be mapped on a separate table, as Figure 9 (a) indicates. Figure 9 (a) shows a table wherein the terminal IDs (902) of the PHS terminals (106) carried by multiple plant maintenance crew members are designated to correspond to the respective plant maintenance crew name (901).

[0057]

The correspondence relationship of the plant ID (804) with the maintenance crew member name (801), on the other hand, is variable, and therefore, it cannot be designated as a fixed value on the table shown in Figure 8, but since a fixed correspondence relationship suffices between the area ID (803) and the plant ID (804), it may be mapped on a separate table, as Figure 9 (b) indicates. Figure 9 (b) is a table which shows the correspondences of the area IDs (904) of areas which include multiple plants with the plant IDs (903) of the respective plants.

[0058]

The RAS (102) can accordingly discern the correspondence relationship between the terminal ID (501) and the area ID (502), namely the correspondence relationship between the terminal ID (802) and the area ID (803), based on the acquired area information (401), and therefore, the correspondence relationship between the maintenance crew member name (801) and the plant ID (804) can eventually be discerned. It is thus that the currently checked plant corresponding to the plant maintenance crew member is specified by the RAS (102).

[0059]

A case where the plant maintenance crew member name (801) in the table shown in Figure 8 is the "maintenance crew member X" may, for example, be considered, where this "maintenance crew

member X" carries a PHS terminal (106) wherein the terminal ID (802) is "PHS #1." The RAS (102) discerns the existence of "PHS #1" in "area #2" from the area information (401) acquired from the intercom switching machine (107), as a result of which said "area #2" becomes designated as the area ID (803), whereas "plant B," namely the plant ID corresponding to "area #2," is designated as the plant ID (804). It is thus that the RAS (102) can specify that the currently checked plant corresponding to the "maintenance crew member X" is "plant B."

[0060]

Next, an action for specifying the next-to-be-checked plant will be explained.

[0061]

As far as the plant network system of this application embodiment of the present invention is concerned, the RAS (102) is orchestrated not only to memorize and manage a scheduled checkup route that describes the order by which the plants are scheduled to be checked by multiple plant maintenance crew members in relation to each plant maintenance crew member but also to specify the plant scheduled to be checked next by the plant maintenance crew member corresponding to /7



the previously specified currently checked plant based on this scheduled checkup route as well as on the previously specified currently checked plant.

[0062]

Figure 10 is a demonstrational diagram which shows an example of the scheduled checkup route.

[0063]

As Figure 10 indicates, a case where a given plant maintenance crew member exits the office (1001), heads for the plant A (301a), heads for the plant B (301b) upon the completion of the checkup of the plant A (301a), heads for the plant D (301d) upon the completion of the checkup of the plant B (301b), heads for the plant C (301c) upon the completion of the checkup of the plant D (301d), and then returns to the office (1001) upon the completion of the checkup of the plant C (301c) may, for example, be considered.

[0064]

In this case, the scheduled checkup route of said plant maintenance crew member is expressed as "plant A (301a)" → "plant B (301b)" → "plant D (301d)" → "plant C (301c)."

[0065]

As Figure 11 concretely illustrates, the RAS (102) can thereby memorize and manage the scheduled checkup route with

reference to a table wherein the correspondence of the scheduled checkup route information (1103) constituted by the plant IDs (1102) listed in the aforementioned order of the scheduled checkup route with each of the multiple plant maintenance crew member names (1101) is established.

[0066]

The RAS (102) can then specify the next-to-be-checked plant by determining the plant ID (1102) of the plant scheduled to be checked next by the plant maintenance crew member for whom the currently checked plant specification mechanism has previously been specified based on the scheduled checkup route information (1103) corresponding to the plant maintenance crew member name (1101) of said plant maintenance crew member.

[0067]

In a case where the plant maintenance crew member name (1101) in the table shown in Figure 11 is the "maintenance crew member X" is explained, for example, the RAS (102) can specify that the plant scheduled to be checked next by the "maintenance crew member X" is the "plant D" if the currently checked plant corresponding to the "maintenance crew member X" can be specified as the "plant B."

[0068]

• After the RAS (102) has thus specified the currently checked plant and next-to-be-checked plant for the plant maintenance crew member according to the aforementioned procedures, it feeds in advance the plant information (109) corresponding to said next-to-be-checked plant into the information processing terminal (112) connected to the PHS terminal (106) carried by the plant maintenance crew member on checkup duty at said currently checked plant.

[0069]

More specifically, as (1201) in Figure 12 indicates, the plant ID (1102) of the next-to-be-checked plant for the plant maintenance crew member is initially communicated to the information server (101) via the information LAN.

[0070]

As (1202) in Figure 12 indicates, upon the reception of the plant ID (1102), the information server (101) decodes, among the sets of plant information (109) managed by itself, the plant information (109) corresponding to the plant ID (201) that coincides with said plant ID (1102) from the database (111) and then transfers it into the RAS (102) via the information LAN, and therefore, upon the reception of the plant information (109) from the information server (101), the RAS (102) determines the terminal ID (802) corresponding to the plant ID (804) of the plant

currently checked by the plant maintenance crew member with reference to the table shown in Figure 8 and then calls the PHS terminal (106) indicated by the terminal ID (802) thus determined.

[0071]

Upon the call transmission to the PHS terminal (106), the intercom switching machine (107) determines the area in which this PHS terminal (106) exists based on the area information (401) memorized and managed by itself and then transmits broadcast information for notifying the call arrival at said PHS terminal (106) to the wireless base station (105) that covers the area thus determined. Incidentally, the wireless base station (105) that serves as the destination of the broadcast information corresponds to the wireless base station (105) that covers the area indicated by the area ID (803) corresponding to the plant ID (804) of the currently checked plant in the table shown in Figure 8.

[0072]

In a case where the PHS terminal (106) then responds and where connections with said PHS terminal (106) become established at both physical and data link levels, the RAS (102) transmits the plant information (109) received from the information server (101) to the information processing terminal (112) connected to the PHS terminal (106) via the intercom wireless telephone network (108), as (1203) in Figure 12 indicates.

[0073]

In such a case, the plant maintenance crew member can receive, prior to the commencement of the checkup at the next-to-be-checked plant, the plant information (109) corresponding to said next-to-be-checked plant via the information processing terminal (112) connected to the PHS terminal (106) carried by itself, based on which he or she can be prepared for the checkup at the next-to-be-checked plant.

[0074]

Next, actions ascribed to the aforementioned first characteristic will be briefly explained with reference to the flow chart shown in Figure 13.

[0175]

Incidentally, a case where the RAS (102) deals with a plant maintenance crew member who is assigned to the scheduled checkup route shown in Figure 10 is hereby instantiated. A singular wireless base station (105), furthermore, is presumed to cover the area which includes the office (1001).

[0076]

As Figure 13 indicates, while the plant maintenance crew member stays in the office (1001) or while he or she is on the way to the next-to-be-checked plant, namely the "plant A (301a)," from the office (1001), the RAS (102) searches the plant information

(109) managed by the information server (101) for the plant information (109) corresponding to the "plant A (301a)" (step 1301) and then transmits the searched plant information (109) to the information processing terminal (112) connected to the PHS terminal (106) carried by said plant maintenance crew member (step 1302).

[0077]

As a result, as Figure 14 indicates, the plant maintenance crew member can, either while the plant maintenance crew member stays in the office (1001) or while he or she is on the way to the next-to-be-checked plant, namely the "plant A (301a)," from the office (1001), receive the plant /8 information (109) corresponding to the "plant A (301a)," and therefore, he or she can be prepared for the checkup of the "plant A (301a)."

[0078]

As has been mentioned above, the RAS (102) subsequently acquires the area information (401) memorized and managed by the intercom switching machine (107) by polling said area information (401), and therefore, in a case where it has detected the movement of the plant maintenance crew member to the "plant A (301a)" from the acquired area information (401) (step 1303), it searches the plant information (109) managed by the information server (101)

for the plant information (109) corresponding to the next-to-be-checked plant, namely the "plant B (301b)" (step 1304), and then transmits the searched plant information (109) to the information processing terminal (112) connected to the PHS terminal (106) carried by said plant maintenance crew member (step 1305).

[0079]

In such a case, as Figure 14 indicates, the plant maintenance crew member can receive the plant information (109) corresponding to the "plant B (301b)" during the checkup of the currently checked plant, namely "plant A (301a)," or during the interval between the completion of the checkup at the "plant A (301a)" and the arrival at the next-to-be-checked plant, namely the "plant B (301b)," based on which he or she can be prepared for the checkup operation at the "plant B (301b)."

[0080]

Likewise, in a case where the RAS (102) has detected the movement of the plant maintenance crew member to the "plant B (301b)" based on the acquired area information (401) (step 1306), it searches the plant information (109) managed by the information server (101) for the plant information (109) corresponding to the next-to-be-checked plant, namely the "plant D (301d)" (step 1307), and then transmits the searched plant information (109) to the information processing terminal (112) connected to the PHS

terminal (106) carried by the plant maintenance crew member (step 1308).

[0081]

In such a case, as Figure 14 indicates, the plant maintenance crew member can receive the plant information (109) corresponding to the "plant D (301d)" during the checkup of the currently checked plant, namely "plant B (301b)," or during the interval between the completion of the checkup at the "plant B (301b)" and the arrival at the next-to-be-checked plant, namely the "plant D (301d)," based on which he or she can be prepared for the checkup operation at the "plant D (301d)."

[0082]

Likewise, in a case where the RAS (102) has detected the movement of the plant maintenance crew member to the "plant D (301d)" based on the acquired area information (401) (step 1309), it searches the plant information (109) managed by the information server (101) for the plant information (109) corresponding to the next-to-be-checked plant, namely the "plant C (301c)" (step 1310), and then transmits the searched plant information (109) to the information processing terminal (112) connected to the PHS terminal (106) carried by the plant maintenance crew member (step 1311).

[0083]



In such a case, as Figure 14 indicates, the plant maintenance crew member can receive the plant information (109) corresponding to the "plant C (301c)" during the checkup of the currently checked plant, namely "plant D (301d)," or during the interval between the completion of the checkup at the "plant D (301d)" and the arrival at the next-to-be-checked plant, namely the "plant C (301c)," based on which he or she can be fully prepared for the checkup operation at the "plant C (301c)."

[0084]

Incidentally, while the plant information (109) is being received via the information processing terminal (112), another routine can be executed, and therefore, the plant maintenance crew member can receive the plant information (109) corresponding to the next-to-be-checked plant in the background without the need to be aware of it while engaging in his or her operation.

[0085]

The RAS (102), furthermore, is orchestrated to transmit a call to the PHS terminal (106) on every occasion for transmitting the plant information (109), although it is also possible for a call which also serves as a status report to be transmitted from the PHS terminal (106) to the PHS terminal (106) upon the completion of the checkup of a given plant by the plant maintenance crew member.

[0086]

The RAS (102), furthermore, is orchestrated to transmit a call to the PHS terminal (106) on every occasion for transmitting the plant information (109), although it is possible for a call to be transmitted from either of the RAS (102) and the PHS terminal (106) to the other during or prior to the dispatch of the plant maintenance crew member for checkup duty in such a way that a state where connections between the RAS (102) and PHS terminal (106) are established at both physical and data link levels will remain perpetuated until the completion of the entire checkup mission, and in such a case, there is no need for the RAS (102) to transmit a call to the PHS terminal (106) on every occasion for transmitting the plant information (109).

[0087]

In actuality, furthermore, the plant information (109) may be transmitted by the information server (101) rather than the RAS (102), and in such a case, the RAS (102) may be orchestrated to notify the information server (101), via the information LAN, of the terminal ID (802) of the PHS terminal (106) carried by the plant maintenance crew member with reference to the table shown in Figure 8 together with the plant ID (1102) of the plant scheduled to be checked next by said plant maintenance crew member.

[0088]

Incidentally, a phenomenon whereby the plant maintenance crew member moves from the area that includes the currently checked plant into the area that includes the next-to-be-checked plant arises during the interval between the completion of the checkup at the currently checked plant and his or her arrival at the next-to-be-checked plant, and in actuality, therefore, the PHS terminal (106) carried by the plant maintenance crew member comes, in a case where such a phenomenon has arisen in the midst of the reception of the plant information (109), to execute a hand-over routine, namely a routine for redesignating wireless base stations (105) which transmit and/or receive wireless signals. In such a case, the wireless line that the PHS terminal (106) has previously been using becomes severed, due to which a reception error becomes incurred.

/9

[0089]

In the following therefore, the possibility of preserving the reliability of the plant information (109) in such a case by means of an error recovery will be briefly explained.

[0090]

In actuality, the RAS (102) is an information processing device such as a personal computer, etc., and as Figure 15 indicates, it is connected to the intercom switching machine (107) via the modem (1501). In actuality, furthermore, the information

processing terminal (112) is connected to the PHS terminal (106) via the modem card (1502), which may be interfaced either internally or externally, as Figure 15 indicates.

[0091]

Generally speaking, an error occurrence frequency of 1 bit/10 sec. is realistically expected in the 9600 bps communications modality, for example, and a stable data transfer is ensured by detecting and correcting these errors within communications applications or modems. A representative example is the MNP (Microcom Networking Protocol), namely a technique for correcting errors and for compressing data proposed by Microcom Co. (U.S.A.).

[0092]

Incidentally, in a case where the error correction function is assigned to the communications application, the processing burden during the communications increases, and therefore, it is more generally assigned to the modem, and such a modem adopts the automatic retransmission format, whereby data are transmitted as divided blocks and whereby blocks in which errors have occurred are retransmitted for correcting errors and completely eradicating errors.

[0093]

In a case where the plant information (109) is transmitted by using the modem (1501), which is endowed with an error correcting

function, and the modem card (1502) therefore, the consequence of a hand-over routine executed at the intercom wireless telephone network (108) level can be covered on the modem side, based on which the quality level can be upgraded to the extent that can endure data transmission. In other words, errors incurred during the hand-over routine can be recovered, and the reliability of the plant information (109) can be ensured.

[0094]

As the foregoing explanations have demonstrated, as far as the plant network system of this application embodiment of the present invention is concerned, the currently checked plant and next-to-be-checked plant for a plant maintenance crew member are specified, and the plant information (109) corresponding to the next-to-be-checked plant is fed in advance, via the intercom wireless telephone network (108), into the information processing terminal (112) connected with the PHS terminal (106) carried by said plant maintenance crew member prior to the commencement of the checkup at the next-to-be-checked plant, based on which a state where the plant information (109) necessary for the checkup at the next-to-be-checked plant is being cached in the information processing terminal (112) can be realized.

[0095]

Even in a case where high-volume image data such as drawing information prevail as the plant information (109), therefore, the plant information (109) can be transmitted both quickly and assuredly into the information processing terminal (112) connected with the PHS terminal (106) carried by the plant maintenance crew member by using the intercom wireless telephone network (108), the band of which is relatively narrow, the delay of which is substantial, and which is unstable.

[0096]

The plant network system of this application embodiment of the present invention can therefore realize a high-speed access of the plant information (109) without hindering the operation of the plant maintenance crew member.

[0097]

Next, actions ascribed to the aforementioned second characteristic will be explained.

[0098]

In the context of transmitting the response manual information (110) corresponding to a plant which is likely to experience an anomaly, it is necessary not only to detect such a plant which is likely to experience such an anomaly (hereafter referred to as the "anomalous plant") but also to specify at least one member selected from between the plant maintenance crew member

who is currently checking the anomalous plant and the plant maintenance crew member who is scheduled next to check the anomalous plant.

[0099]

The action for detecting the anomalous plant will be explained first in this context.

[0100]

As far as the plant network system of this application embodiment of the present invention is concerned, at least one controller (104) is configured for each of the multiple plants for the purpose of gathering the plant control information (113), namely information that shows the operative status of the corresponding plant, as has been mentioned above.

[0101]

More specifically, the controller (104) is connected distally to various sensors and actuators, etc., and the controller (104) is designed to gather various sets of information provided by these sensors and actuators, etc. as the plant control information (113) and to notify the control server (103) of them via the control LAN.

[0102]

The control server (103) manages the plant control information (113) by storing the plant control information (113)

included within the notification from the controllers (104) into the database (114), as Figure 2 (b) indicates, and the anomalous plant can be detected from the plant control information (113) in this case.

[0103]

In other words, the control server (113) [sic: Presumably "(103)"] judges whether not the plant control information (113) has deviated from its normal range by judging whether or not the value of the plant control information (113) has exceeded a preliminarily designated threshold value, and the plant corresponding to the plant control information (113) can be detected as the anomalous plant in a case where it has deviated from its normal range.

[0104]

The control server (113) [sic] notifies, upon the detection of the anomalous plant, the RAS (102) of the plant ID (203) of the anomalous plant via the information LAN.

[0105]

Next, the action for specifying least one member selected from between the plant maintenance crew member who is currently checking the anomalous plant and the plant maintenance crew member who is scheduled next to check the anomalous plant will be explained.



[0106]

The RAS (102) determines, upon the reception of the plant ID (203) of the anomalous plant from the control server (103), the plant maintenance crew member name (801) corresponding to the plant ID (804) that coincides with this plant ID (203) with reference to the table shown in Figure 8, based on which the plant maintenance crew member who is currently checking the anomalous /10 plant can be specified.

[0107]

In a case where the plant ID (203) received from the control server (103) is the "plant B" with reference to the table shown in Figure 8, for example, the RAS (102) determines that the plant maintenance crew member name (801) corresponding to the "plant B" is the "maintenance crew member X," based on which the plant maintenance crew member currently checking the anomalous plant, namely "plant B," can be specified as the "maintenance crew member X."

[0108]

The RAS (102) can, furthermore, specify the plant maintenance crew member scheduled next to check the anomalous plant by determining the entire sets of scheduled checkup route information (1103) that describe the plant ID (1102) which coincides with the

plant ID (203) received from the control server (103) in the table shown in Figure 11 (which is equivalent to the plant ID (1102) of the next-to-be-checked plant), namely the plant maintenance crew member name (1101) corresponding to said scheduled checkup route information (1103) and the plant ID (1102) listed as the very first of said plant IDs (1102) (which is equivalent to the plant ID (1102) of currently checked plant) and by determining the plant maintenance crew member name (801) and plant ID (804) that coincide with the correspondence relationship between the plant maintenance crew member name (1101) and plant ID (1102) determined with reference to the table shown in Figure 8.

[0109]

The RAS (102) may, for example, determine that, in a case where the plant ID (203) received from the control server (103) is the "plant B," the plant maintenance crew member names (1101) corresponding to the scheduled checkup route information (1103) that stipulates the "plant B" are the "maintenance crew member X" and "maintenance crew member Z," based on which it becomes informed that the "plant B" is included in the scheduled checkup routes for the "maintenance crew member X" and "maintenance crew member Z."

[0110]

The RAS (102), furthermore, determines with reference to the table shown in Figure 11 that the respective plant IDs (1102) for the "maintenance crew member X" and "maintenance crew member Z" are the "plant A" and "plant D" in the column that precedes that for the "plant B" by one, based on which it becomes informed that the plant scheduled to be checked by the "maintenance crew member X" prior to the checkup of the "plant B" is the "plant A" and that the plant scheduled to be checked by the "maintenance crew member Z" prior to the checkup of the "plant B" is the "plant D."

[0111]

The RAS (102) then determines with reference to the table shown in Figure 8 that the plant ID (804) corresponding to the "maintenance crew member X" is the "plant B" and that the plant ID (804) corresponding to the "maintenance crew member Z" is the "plant D" and thus becomes informed that the "maintenance crew member Z" is currently checking the "plant D," namely the plant scheduled to be checked prior to the "plant B."

[0112].

It is thus that the RAS (102) specifies that the plant maintenance crew member scheduled next to check the anomalous plant is the "maintenance crew member Z." Incidentally, the "maintenance crew member X" is designated as the plant maintenance

crew member currently checking the anomalous plant, namely the "plant B."

[0113]

Coincidentally, after the RAS (102) has specified least one member selected from between the plant maintenance crew member who is currently checking the anomalous plant and the plant maintenance crew member who is scheduled next to check the anomalous plant upon the notification of an anomalous server from the control server (103) according to the aforementioned procedures, it transmits the response manual information (110) on a response to be rendered against said anomalous plant into the information processing terminal (112) connected to the PHS terminal (106) carried by the specified plant maintenance crew member.

[0114]

More specifically, the RAS (102) initially notifies the information server (101) of the plant ID (203), which has in turn been notified from the control server (103), via the information LAN, as (1601) in Figure 16 indicates.

[0115]

As (1602) in Figure 16 indicates, the information server (101) searches, upon the reception of the plant ID (203), the contents of the response manual information (110) being managed by

itself and then decodes from the database (111) the response manual information (110) corresponding to the plant ID (201) that coincides with said plant ID (203), and it then transfers it into the RAS (102) via the information LAN, due to which the RAS (102) determines, upon the reception of the response manual information (110) from the information server (101), the terminal ID (802) corresponding to the plant maintenance crew member name (801) of the previously specified plant maintenance crew member with reference to the table shown in Figure 8 and then transmits it into the PHS terminal (106) indicated by the determined terminal ID (802).

[0116]

The intercom switching machine (107) determines, upon the transmission of a call to the PHS terminal (106), the area in which this PHS terminal (106) exists based on the area information (401) memorized and managed by itself and then transmits broadcast information that signifies a call arrival at said PHS terminal (106) to the wireless base station (105) that covers the determined area.

[0117]

In a case where the PHS terminal (106) then responds and where connections with the PHS terminal (106) become established at both physical and data link levels, the RAS (102) transmits the

response manual information (110) received from the information server (101) into the information processing terminal (112) connected to the PHS terminal (106) via the intercom wireless telephone network (108), as (1603) in Figure 16 indicates.

[0118]

Incidentally, it is desirable for the RAS (102) to transmit a message which at least identifies the anomalous plant together with the response manual information (110) for enabling the plant maintenance crew member to identify the anomalous plant.

[0119]

In a case where the plant information (109) is being transmitted based on the action ascribed to the aforementioned first characteristic, furthermore, the RAS (102) may interrupt the transmission of the plant information (109) and transmit the response manual information (110) instead or may transmit the response manual information (110) upon the completion of the transmission of the plant information (109).

[0120]

It is thus that the plant maintenance crew member can, in a case where an anomaly is       /11  
likely to arise in the currently checked plant or where an anomaly is likely to arise in the plant scheduled next to check, receive the response manual information (110) corresponding to either

plant via the information processing terminal (112) connected to the PHS terminal (106) carried by himself or herself and that he or she can be prepared to render a response to a potential anomaly.

[0121]

Incidentally, an additional routine can be executed via the information processing terminal (112) while the response manual information (110) is being received, and the plant maintenance crew member can therefore receive the response manual information (110) corresponding to the anomalous plant in the background without the need to be aware of it while engaging in his or her operation.

[0122]

The RAS (102), furthermore, is orchestrated, in a case where the response manual information (110) is transmitted, to transmit a call to the PHS terminal (106), whereas in an alternative embodiment, a call is transmitted from either of the RAS (102) and the PHS terminal (106) to the other during or before the dispatch of the plant maintenance crew member for checkup in such a way that a state where connections between the RAS (102) and the PHS terminal (106) are established at both physical and data link levels will remain perpetuated until the completions of all the checkup assignments for the plant maintenance crew member, and in

such a case, there is no need for the RAS (102) to transmit a call to the PHS terminal (106) at the time of the transmission of the response manual information (110).

[0123]

In actuality, furthermore, the response manual information (110) may be transmitted from the information server (101) rather than the RAS (102), and in such a case, the RAS (102) may be orchestrated to notify the information server (101), via the information LAN, of the terminal ID (802) of the PHS terminal (106) carried by the plant maintenance crew member specified with reference to the table shown in Figure 8 together with the plant ID (203) of the anomalous plant.

[0124]

The RAS (102) may, furthermore, be orchestrated, in a case where neither the plant maintenance crew member who is currently checking the anomalous plant nor the plant maintenance crew member scheduled next to check the anomalous plant can be specified, to transmit the response manual information (110) corresponding to the anomalous plant into the information processing terminal (112) of the PHS terminal (106) carried by another plant maintenance crew member(s) (e.g., preliminarily designated plant maintenance crew member, all plant maintenance crew members, plant maintenance crew member for whom the plant ID (1102) of the anomalous plant



has been coded as the scheduled checkup route information (1103), etc.).

[0125]

As the foregoing explanations have demonstrated, the plant network system of the application embodiment of the present invention is orchestrated not only to detect an anomalous plant, namely a plant in which an anomaly is likely to occur, but also to specify at least one member selected from between the plant maintenance crew member who is currently checking the anomalous plant and the plant maintenance crew member who is scheduled next to check the anomalous plant and then transmit, via the intercom wireless telephone network (108), the response manual information (110) corresponding to the anomalous plant into the information processing terminal (112) connected to the PHS terminal (106) carried by the specified plant maintenance crew member, based on which a state where the response manual information (110) necessary for rendering a response to an adventitiously arising anomaly is being cached in the information processing terminal (112) can be realized prior to the arising of such an anomaly.

[0126]

Even in a case where high-volume image data such as drawing information prevail as the response manual information (110), therefore, the response manual information (110) can be

transmitted both quickly and assuredly into the information processing terminal (112) connected with the PHS terminal (106) carried by the plant maintenance crew member by using the intercom wireless telephone network (108), the band of which is relatively narrow, the delay of which is substantial, and which is unstable.

[0127]

The plant network system of this application embodiment of the present invention can therefore realize a high-speed access of the response manual information (110) without hindering the operation of the plant maintenance crew member.

[0128]

The functions of the plant network system of the application embodiment of the present invention, furthermore, are divided into three types, namely the memorizations/managements of the plant information (109) and response manual information (110), transmissions of the plant information (109) and the response manual information (110), and the detections of anomalous plants, and three servers (101) through (103) are designated as constituent members for distributing the respective functions among these three servers (101) through (103), although one or two servers may instead be designated as constituent members.

[0129]

Either the action ascribed to the aforementioned first characteristic or the action ascribed to the second characteristic alone may, furthermore, be invoked in the plant network system of the application embodiment of the present invention.

[0130]

(Effects of the invention)

As the foregoing explanations have demonstrated, the present invention provides a plant network system which, prior to the commencement of the checkup of a plant to be checked next by a plant maintenance crew member who checks such plants, enables the plant maintenance crew member to access plant information at a high speed by feeding in advance the plant information constituted by information necessary for the checkup of the plant scheduled to be checked next into an information processing terminal connected to a wireless telephone terminal carried by said plant maintenance crew member via an intercom wireless telephone network.

[0131]

The present invention also provides a plant network system which, in a case where a plant which is likely to experience an anomaly has been detected, transmits response manual information constituted by information necessary during the rendition of a response to the anomaly of said plant into an information

processing terminal connected to a wireless telephone terminal carried by at least one member selected from between the plant maintenance crew member who is currently checking said plant and the plant maintenance crew member who is scheduled next to check said plant via an intercom wireless telephone network for enabling said plant maintenance crew member to access the response manual information at a high speed.

[0132]

Thus, the plant network system of the present invention affords plant maintenance crew members a convenient operation similar to those for non-wireless network systems even if the PHS, the transmission speed of which is lower than those of non-wireless LANs by two orders of /12 significance, is used.

#### Brief explanation of the figures

Figure 1: An overall constitutional diagram for the plant network system of the application embodiment of the present invention.

Figure 2: A demonstrational diagram which shows the methodology for memorizing plant information, response manual information, and plant control information within a database.

Figure 3: A demonstrational diagram which shows the methodology for configuring wireless base stations.

Figure 4: A demonstrational diagram which shows the positional registration executed via a PHS terminal.

Figure 5: A demonstrational diagram which shows the area information memorized and managed by the intercom switching machine.

Figure 6: A sequential diagram of a case where various sets of information on the positional registration are exchanged between the PHS terminal and wireless base stations.

Figure 7: A demonstrational diagram which shows the stealing of area information by the remote access server.

Figure 8: A demonstrational diagram which shows the currently checked plant information memorized and managed by the remote access server.

Figure 9: A demonstrational diagram which shows a table for mapping the contents of the currently checked plant information.

Figure 10: A demonstrational diagram which shows an example of scheduled checkup route.

Figure 11: A demonstrational diagram which shows the scheduled checkup route memorized and managed by the remote access server.

Figure 12: A demonstrational diagram which shows the transmission of plant information executed by the remote access server.

Figure 13: A flow chart which shows the action for transmitting the plant information.

Figure 14: A time chart which shows the action for transmitting the plant information.

Figure 15: A demonstrational diagram which shows a method for connecting the remote access server and information processing terminal.

Figure 16: A demonstrational diagram which shows the transmission of response manual information executed by the remote access server.

(Explanation of notations)

(101): Information server; (102): Remote access server (RAS);  
(103): Control server; (104): Controller; (105): Wireless base station; (106): PHS terminal; (107): Intercom switching machine; (108): Intercom wireless telephone network; (109): Plant information; (110): Response manual information; (111): Database; (112): Information processing terminal; (113): Plant control information; (114): Database; (201): Plant ID; (202): Controller ID; (203): Plant ID; (301): Plant; (302): Area; (401): Area



[(I): Information LAN; (C): Control LAN; (101): Information server; (103): Control server; (104): Controllers; (105): Wireless base stations; (106): PHS terminal; (107): Intercom switching machine; (108): Intercom wireless telephone network; (109): Plant information; (110): Response manual information; (111): Database; (112): Information processing terminal; (113): Plant control information; (114): Database]

Figure 5  
Area information

|             |          |
|-------------|----------|
| 501<br>↓    | 502<br>↓ |
| Terminal ID | Area ID  |
| PHS #1      | Area #2  |
| PHS #2      | Area #1  |
| .           | .        |
| .           | .        |
| .           | .        |
| PHS #n      | Area #m  |



Figures 2

/13

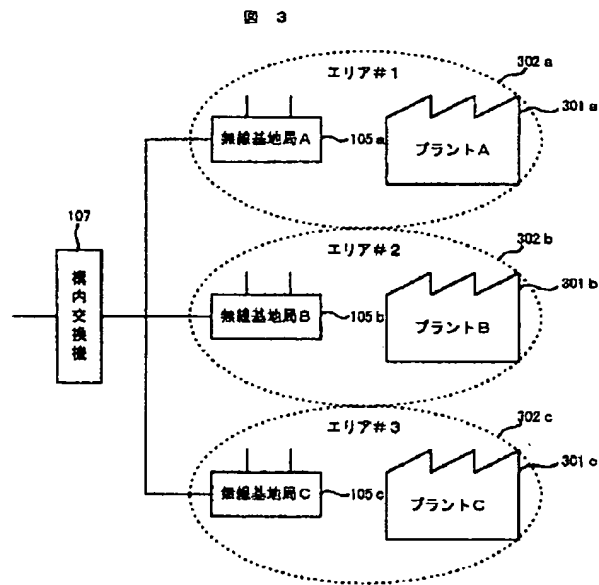
(a)

|          |                                  |                                               |
|----------|----------------------------------|-----------------------------------------------|
| 201<br>↓ | 109<br>↓                         | 110<br>↓                                      |
| Plant ID | Plant information                | Response manual<br>information                |
| Plant A  | Plant information<br>for plant A | Response manual<br>information for<br>plant A |
| Plant B  | Plant information<br>for plant B | Response manual<br>information for<br>plant B |
| .        | .                                | .                                             |
| .        | .                                | .                                             |
| .        | .                                | .                                             |
| Plant Z  | Plant information<br>for plant Z | Response manual<br>information for<br>plant Z |

(b)

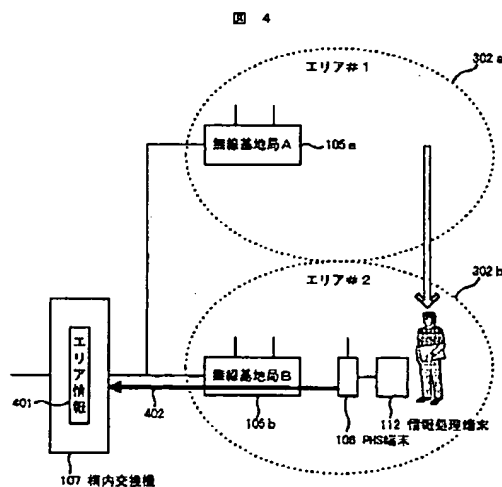
|          |                                    |                                                                                                            |
|----------|------------------------------------|------------------------------------------------------------------------------------------------------------|
| 203<br>↓ | 202<br>↓                           | 113<br>↓                                                                                                   |
| Plant ID | Controller #1                      | Plant control<br>information for<br>Controller #1                                                          |
| Plant A  | Controller #1<br><br>Controller #2 | Plant control<br>information for<br>Controller #1<br><br>Plant control<br>information for<br>Controller #2 |
| Plant B  | Controller #3                      | Plant control<br>information for<br>Controller #3                                                          |
| .        | .                                  | .                                                                                                          |
| .        | .                                  | .                                                                                                          |
| .        | .                                  | .                                                                                                          |
| Plant Z  | Controller #m                      | Plant control<br>information for<br>Controller #m                                                          |

Figure 3



[(107): Intercom switching machine; (105a): Wireless base station A; (105b): Wireless base station B; (105c): Wireless base station C; (301a): Plant A; (301b): Plant B; (301c): Plant C; (302a): Area #1; (302b): Area #2; (302c): Area #3]

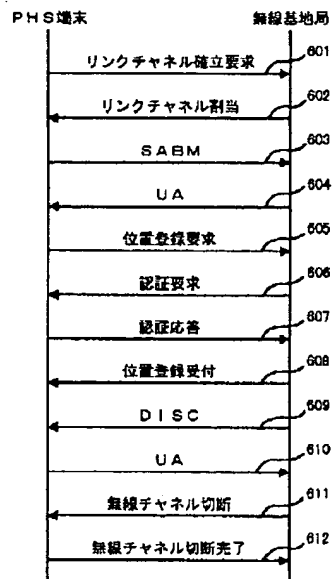
Figure 4



[(105a): Wireless base station A; (105b): Wireless base station B;  
 (106): PHS terminal; (107): Intercom switching machine; (112):  
 Information processing terminal; (302a): Area #1; (302b): Area #2;  
 (401): Area information]

Figure 6

図 6



[(A): PHS terminal; (B): Wireless base station; (601): Link  
 channel establishment request; (602): Link channel assignment;  
 (605): Positional registration request; (606): Acknowledgment  
 request; (607): Acknowledgment response; (608): Positional  
 registration acceptance; (611): Wireless channel severance; (612):  
 Wireless channel severance completion]

Figure 8

Currently checked plant information

| 801<br>↓                           | 802<br>↓    | 803<br>↓ | 804<br>↓ |
|------------------------------------|-------------|----------|----------|
| Maintenance<br>crew member<br>name | Terminal ID | Area ID  | Plant ID |
| Maintenance<br>crew member X       | PHS #1      | Area #2  | Plant B  |
| Maintenance<br>crew member Y       | PHS #2      | Area #1  | Plant A  |
| .                                  | .           | .        | .        |
| .                                  | .           | .        | .        |
| .                                  | .           | .        | .        |
| Maintenance<br>crew member Z       | PHS #n      | Area #4  | Plant D  |

Figures 9

(a)

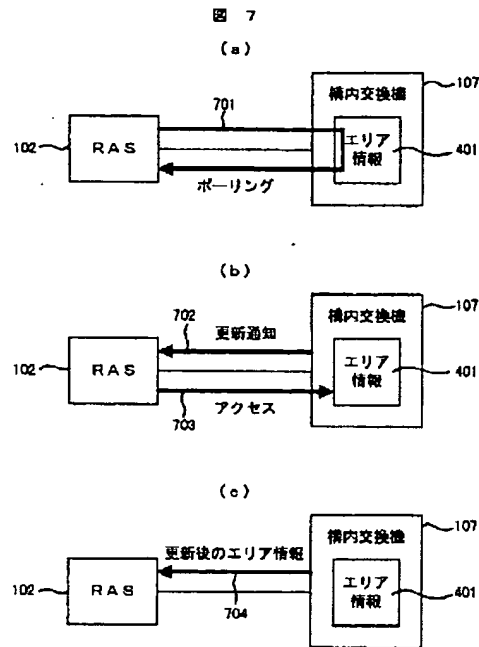
|                              |             |
|------------------------------|-------------|
| 901<br>↓                     | 902<br>↓    |
| Maintenance crew member name | Terminal ID |
| Maintenance crew member X    | PHS #1      |
| Maintenance crew member Y    | PHS #2      |
| .                            | .           |
| .                            | .           |
| .                            | .           |
| Maintenance crew member Z    | PHS #n      |

(b)

|          |          |
|----------|----------|
| 903<br>↓ | 904<br>↓ |
| Plant ID | Area ID  |
| Plant A  | Area #1  |
| Plant B  | Area #2  |
| .        | .        |
| .        | .        |
| .        | .        |
| Plant Z  | Area #m  |

Figures 7

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(a)

[(107): Intercom switching machine; (401): Area information;  
(701): Polling]

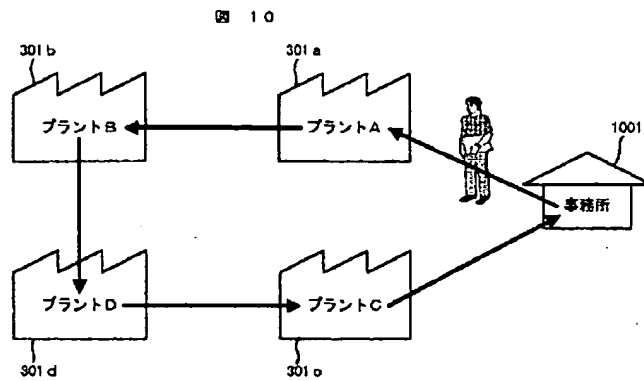
(b)

[(107): Intercom switching machine; (401): Area information;  
(702): Access; (703): Renewal notification]

(c)

[(107): Intercom switching machine; (401): Area information;  
(704): Renewed area information]

Figure 10



[(301a): Plant A; (301b): Plant B; (301c): Plant C; (301d): Plant D; (1001): Office]

Figure 11

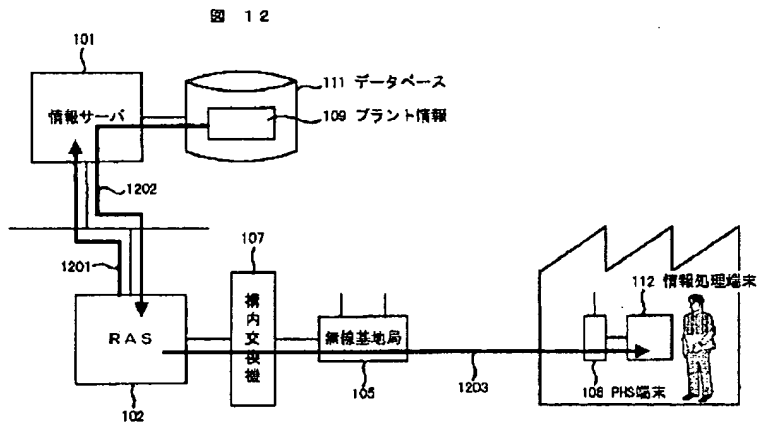
Scheduled checkup route

| 1101<br>↓                    | 1103<br>↓                           |         |         |         |
|------------------------------|-------------------------------------|---------|---------|---------|
| Maintenance crew member name | Scheduled checkup route information |         |         |         |
| Maintenance crew member X    | Plant A                             | Plant B | Plant D | Plant C |
| Maintenance crew member Y    | Plant C                             | Plant F | Plant G | Plant A |



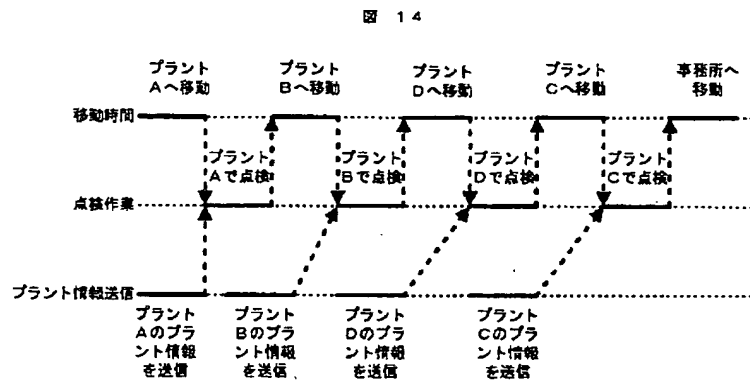
|                           |           |           |           |           |
|---------------------------|-----------|-----------|-----------|-----------|
| .                         | .         | .         | .         | .         |
| .                         | .         | .         | .         | .         |
| .                         | .         | .         | .         | .         |
| Maintenance crew member Z | Plant D   | Plant B   | Plant Z   | Plant Z   |
|                           | ↑<br>1102 | ↑<br>1102 | ↑<br>1102 | ↑<br>1102 |

Figure 12



[(101): Information server; (105): Wireless base station; (106): PHS terminal; (107): Intercom switching machine; (109): Plant information; (111): Database; (112): Information processing terminal]

Figure 14

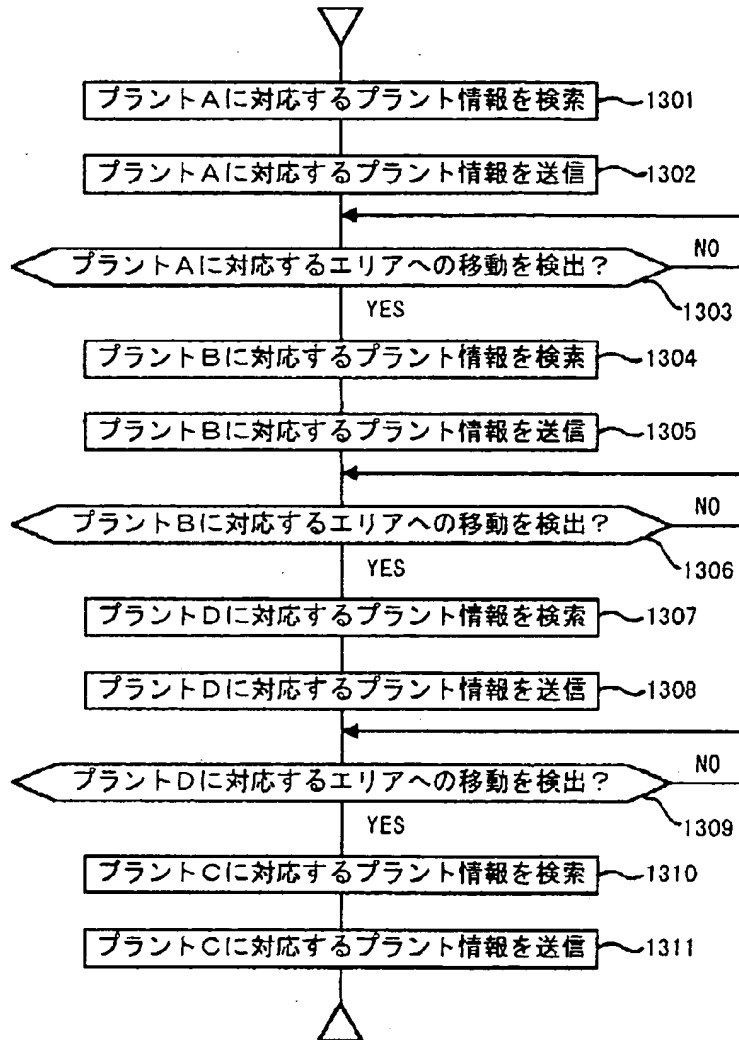


[(1): Movement time; (2): Checkup operation; (3): Plant information transmission; (4): Movement to plant A; (5): Movement to plant B; (6): Movement to plant D; (7): Movement to plant C; (8): Movement to office; (9): Checkup at plant A; (10): Checkup at plant B; (11): Checkup at plant D; (12): Checkup at plant C; (13): Transmission of plant information on plant A; (14): Transmission of plant information on plant B; (15): Transmission of plant information on plant D; (16): Transmission of plant information on plant C]

Figure 13

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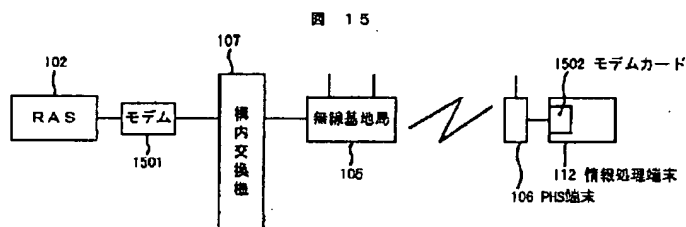
図 13



[(1301): Search for plant information corresponding to plant A;  
(1302): Transmission of plant information corresponding to plant A;  
(1303): Detection of movement into area corresponding to plant A?;  
(1304): Search for plant information corresponding to plant B;  
(1305): Transmission of plant information corresponding to plant B;  
(1306): Detection of movement into area corresponding to plant B?;  
(1307): Search for plant information corresponding to plant D;

(1308): Transmission of plant information corresponding to plant D;  
 (1309): Detection of movement into area corresponding to plant D?  
 (1310): Search for plant information corresponding to plant C;  
 (1311): Transmission of plant information corresponding to plant C]

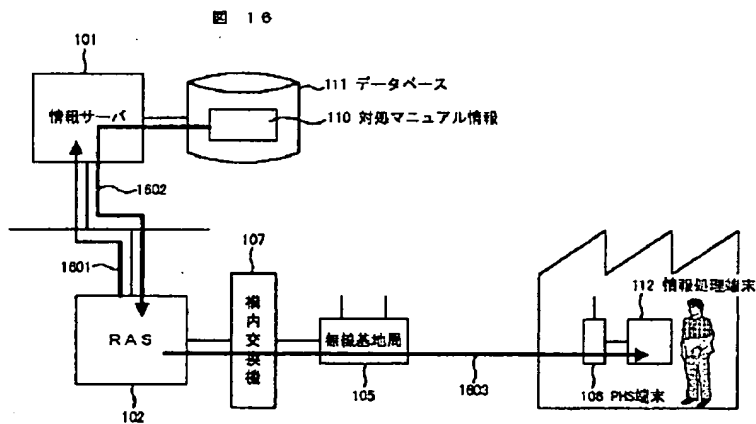
Figure 15



[(105): Wireless base station; (106): PHS terminal; (107): Intercom switching machine; (112): Information processing terminal; (1501): Modem; (1502): Modem card]

Figure 16

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[(101): Information server; (105): Wireless base station; (106): PHS terminal; (107): Intercom switching machine; (110): Response manual information; (111): Database; (112): Information processing terminal]